JACC Vol. 12, No. 1
July 1988:42–8

Triple Vessel Coronary Angioplasty: Acute Outcome and Long-Term Results

GERMANO DiSCIASCIO, MD, MICHAEL J. COWLEY, MD, FACC, GEORGE W. VETROVEC, MD, FACC, KIM M. KELLY, RN, BSN, STEPHEN A. LEWIS, MD, FACC

Richmond, Virginia

Triple vessel coronary angioplasty, defined as angioplasty of one or more lesions in each of the three major coronary arteries (left anterior descending, left circumflex, right coronary artery) was performed in 50 (11%) of 469 patients who had angioplasty of multiple vessels. There were 32 men and 18 women with a mean age of 56 years. All 50 patients had severe three vessel coronary disease and represent approximately 5% of patients with three vessel disease who had revascularization in this institution; 8 (16%) had previous coronary bypass surgery, and 23 (46%) had previous myocardial infarction. Unstable angina was present in 33 patients (66%) and 96% had Canadian Heart Association class III or IV angina; mean left ventricular ejection fraction was 57 ± 11%.

Angioplasty was performed in 176 vessels (3.5 vessels per patient, range 3 to 6) and in 250 lesions (5 lesions per patient, range 3 to 9); angiographic success was achieved in 240 lesions (96%) and 166 vessels (94%). Success in all vessels attempted was achieved in 40 (80%) of the 50 patients. Clinical success (angiographic success associated with clinical improvement) was obtained in all 50 patients in whom triple vessel angioplasty was performed; none of them required urgent bypass surgery and 5 patients (10%) had a non-Q wave myocardial infarction. In four other patients triple vessel angioplasty was planned but not performed because of failure to dilate the primary vessel; urgent bypass surgery was required in one of these, who developed a Q wave infarction. Thus, overall clinical success in 54 patients was 93%; the incidence rate of myocardial infarction was 11%, and that of urgent surgery 1.8%.

All 50 patients who had successful triple vessel angioplasty were followed up >6 months (range 6 to 63, mean 18.4). Clinical recurrence developed in 17 patients (34%), of whom 15 had successful repeat angioplasty and 2 (4%) underwent elective bypass surgery. Two patients (4%) had late myocardial infarction, two (4%) died suddenly and one underwent cardiac transplantation during follow-up. Actuarial event-free survival (no myocardial infarction, death or bypass surgery) was 90% at 2 years. With inclusion of the 15 patients who had repeat angioplasty, 90% of patients are in improved condition (74% are asymptomatic and 16% are in functional class I) without requiring bypass surgery during follow-up. These immediate and long-term results indicate that triple vessel angioplasty is a safe and effective therapy in selected patients with three vessel coronary disease.

(J Am Coll Cardiol 1988;12:42–8)

Percutaneous transluminal coronary angioplasty is an established revascularization technique for patients with symptomatic single vessel coronary disease (1,2). This technique has also been applied in patients with multivessel disease, and efficacy of coronary angioplasty of multiple vessels has been reported in selected patients (3–7). Results with angioplasty of all three major coronary arteries (triple vessel angioplasty), however, have not been characterized. The goal of this study was to analyze our experience with triple vessel angioplasty in patients with severe three vessel coronary artery disease.

Methods

Study patients. Coronary angioplasty of multiple vessels has been performed in selected patients at the Medical College of Virginia since October 1979. Between May 1982 and February 1987, 50 patients had angioplasty of one or more lesions in each of the three major coronary arteries (left

From the Division of Cardiology, Department of Medicine, Medical College of Virginia, Richmond, Virginia.

Manuscript received June 16, 1987; revised manuscript received November 11, 1987, accepted February 10, 1988.

Address for reprints: Germano DiSciascio, MD, MCV Station, Box 36, Richmond, Virginia 23298.

0735-1097/88/$3.50

anterior descending, left circumflex and right coronary artery) or corresponding bypass graft, and they represent the study population. In two-thirds of the patients the procedure was done after January 1986.

All patients were considered candidates for bypass surgery or coronary angioplasty, or both, on the basis of presence and severity of angina pectoris, evidence of myocardial ischemia by exercise or radionuclide studies (unless contraindicated), and severe three vessel coronary artery disease demonstrated by angiography. Three vessel disease was defined by the presence of ≥50% stenosis in all three major vessels, but vessels with <70% stenosis were generally not dilated. Patients were candidates for triple vessel angioplasty when there was a high probability of successful revascularization of all major ischemic segments. It is estimated that in our institution this study population represents 5 to 10% of patients with three vessel disease in whom angioplasty might be suitable. The procedure was not attempted if surgery was considered to offer a more complete revascularization or lower risk. However, some patients were not favorable surgical candidates because of distal vessel disease (that is, lesions in segments so distal that they were considered unsuitable for grafting beyond the lesion), associated severe systemic illness, severely depressed left ventricular function and multiple previous bypass surgery; angioplasty was considered a more reasonable revascularization technique in these patients. Exclusion criteria for coronary angioplasty were unprotected significant left main coronary disease, multiple chronic total occlusions and severe diffuse disease (that is, extensive areas of significant narrowing in multiple segments of the blood vessel) with extensive involvement of all major vessels or branches. A chronic total occlusion was not considered a contraindication to angioplasty; the strategic approach to total occlusion in our center has been previously described (8).

Angioplasty protocol. All procedures were performed with a cardiac surgery team on standby. Angioplasty was performed by standard techniques (2). Patients received aspirin (325 mg daily) and dipyridamole (150 mg daily) and a calcium channel antagonist from the day before until 6 months after the procedure. All patients received intravenous heparin during the procedure and intracoronary nitroglycerin when appropriate. Angioplasty of the vessel considered to be most important (based on lesion severity, vessel size and distribution, and ischemic changes by electrocardiogram (ECG) or thallium-201 imaging) was initially performed, and additional vessels were attempted after angiographic improvement and stable patency of the primary vessel had been demonstrated. A vessel supplying collateral flow was never dilated as a primary vessel in order not to jeopardize extensive myocardial zones in case of failure. The procedure was performed in different sessions ("staged") when dilation of the preceding vessel had angiographic results that would warrant further observation, such as an intimal tear that might progress to occlusive dissection or an intraluminal filling defect consistent with thrombus or intraluminal split, or both, at the dilated site. In some patients staging was performed because of long duration of the procedure or large amount of contrast medium utilized at the first session. The second session was generally performed after 24 or 48 h, or longer in occasional patients. Staging was routinely performed in patients with recent myocardial infarction. Lesion severity was determined by visual assessment as the average percent diameter reduction in multiple views by a consensus reading of two cardiologists experienced in angioplasty. Angiographic success was defined as ≥20% improvement in luminal diameter and reduction of stenosis to ≤50% residual narrowing. Clinical success was defined as clinical improvement of at least one functional class in conjunction with angiographic success in all or in the most important vessels with attempted dilation. Complications were defined as previously described (9).

Follow-up. *Clinical recurrence was defined as return of symptoms or signs of ischemia after initial improvement and angiographic evidence of restenosis of one or more lesions.* Routine angiographic follow-up of patients without symptoms or signs of ischemia was not obtained. Long-term results were assessed in the patients who were followed up a minimum of 6 months after triple vessel angioplasty. Anginal status, functional class (Canadian Heart Association criteria), medications, need for additional revascularization with repeat angioplasty or bypass surgery and the incidence of major events such as myocardial infarction (diagnosed using standard serum enzyme and electrocardiographic criteria) and death, were assessed by follow-up visits or phone interviews of all patients by a trained nurse.

Statistics. Statistical analysis was performed with chi-square testing for discrete variables and a *t* test for continuous variables. Values are expressed as mean ± SD. An actuarial life table analysis was utilized for specific follow-up events (myocardial infarction, death, bypass surgery, recurrence) (10).

Results

Of 1,500 patients who underwent coronary angioplasty at the Medical College of Virginia between July 1979 and February 1987, 120 (8%) had three vessel coronary disease. Of these, 54 (45%) had severe lesions in all three major vessels that appeared suitable for triple vessel angioplasty; this was attempted in 50 of these patients. These 50 patients represent 11% of 469 patients who had angioplasty of multiple vessels at our institution during the same period (Fig. 1).

Clinical characteristics (Table 1). The 50 patients included 32 men and 18 women, with a mean age of 57 ± 9 years (range 40 to 77). All patients had significant three vessel coronary artery disease, and eight (16%) had previous cor-

JACC Vol. 12, No. 1
July 1988:42–8

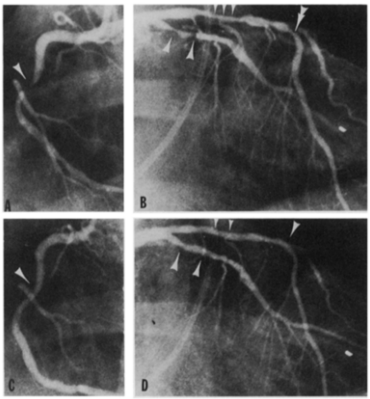

Figure 1. Triple vessel coronary angioplasty in a 41 year old man who presented with unstable angina. **A**, Left anterior oblique view of right coronary artery showing high grade stenosis in the midportion (**arrow**). **B**, Right anterior oblique view of the left coronary artery showing proximal tubular stenosis (**three arrows**) in the left anterior descending artery and a more discrete lesion in its midsection (**arrow**). A tubular stenosis is also present in the proximal circumflex (**two arrows**). **C** and **D**, After triple vessel angioplasty, there is good improvement in luminal diameter at all dilated sites in the right, left anterior descending and left circumflex coronary arteries (**arrows**).

onary bypass surgery. Mean left ventricular ejection fraction was 57 ± 11% (range 28 to 80%) and was <50% in 12 patients (24%); among the latter, ejection fraction was <40% in 4 patients and <30% in 1 patient. Twenty-three patients (46%) had previous myocardial infarction (in 12 patients this occurred <4 weeks before angioplasty, in 11 >4 weeks); 4 patients had previous intravenous streptokinase reperfusion (1 month and 9, 5 and 2 days, respectively, before angioplasty). Unstable angina was present in 33 patients (66%); 27 patients (54%) had class IV angina, 21 (42%) had class III, and 2 had class II. Four patients had previously undergone double vessel angioplasty, respectively, 4 months (two patients), 7 months and 8 months earlier, and triple vessel angioplasty was performed at their second angioplasty procedure because of restenosis and progression of disease in the other vessel.

Angiographic results (Table 2). Angioplasty of a single lesion in each of the three major vessels was performed in 5 patients (10%); in 26 patients (52%) additional sequential lesions were dilated in one or more of the three major

Table 1. Clinical Profile of 50 Patients Undergoing Triple Vessel Angioplasty

		%
Age (yr)		
Mean	57 ± 9	
Range	40 to 77	
Gender		
Male	32	64
Female	18	36
Unstable angina	33	66
Previous MI	23	46
Previous CABG	8	16
Angina class (CHC)		
Class 2	2	4
Class 3	21	42
Class 4	27	54
Mean LVEF		
Mean	57 ± 10%	
Range	28 to 80%	
Risk factors		
Hypertension	28	56
Hypercholesterolemia	8	16
Diabetes	14	28
Family history of CAD	27	54
Smoking	22	44

CABG = coronary artery bypass graft; CAD = coronary artery disease; CHC = Canadian Heart Association classification; LVEF = left ventricular ejection fraction; MI = myocardial infarction.

vessels, and in 19 patients (38%) angioplasty of major branches was also attempted in addition to dilation of the three parent vessels. Overall, angioplasty was performed in 250 lesions (5 lesions per patient, range 3 to 9) and 176 vessels (3.5 vessels per patient, range 3 to 6). Angiographic success was achieved in 166 (94%) of 176 vessels and in 240

Table 2. Angiographic Results in 50 Patients

No. of Lesions With Attempted Dilation	No. of Patients	Total No. of Lesions	No. of Lesion Successes
A. Angiographic Results by Lesions			
3	5	15	12
4	17	68	64
5	14	70	68
6	7	42	41
7	2	14	14
8	4	32	32
9	1	9	9
Total	50	250	240 (96%)
B. Angiographic Results by Vessels			
3	31	93	85
4	14	56	54
5	3	15	15
6	2	12	12
Total	50	176	166 (94%)

(96%) of 250 lesions. Angioplasty of a chronic total occlusion was attempted in 17 patients and was successful in 11 (65%). The mean percent stenosis of all lesions before angioplasty was 87.4 ± 8%, and the mean residual narrowing after angioplasty was 31.1 ± 11% ($p < 0.001$), with a mean percent improvement of 56%. In 22 patients (44%) all three vessels were dilated at the same session. In 28 patients (56%) staged angioplasty was performed, the latter, because of recent (<15 days) myocardial infarction in 7 patients, because of intimal tears of the primary vessel that required further observation in 6, and because of the extent of the disease or long duration of the procedure, or both, in 15.

Angioplasty results by patients. All 50 patients had clinical success with improvement of at least two functional classes or achievement of asymptomatic status. In eight patients, one of the three major vessels with attempted angioplasty could not be dilated; in six of these patients, the unsuccessful vessel had a chronic total occlusion, in one the lesion could be crossed with the wire but not with the balloon because of vessel tortuosity and in one patient the lesion could not be crossed with the wire. In two additional patients, all three major vessels were successfully dilated, but lesions in branches (one obtuse marginal and one diagonal) could not be crossed. Therefore, 42 (84%) of the 50 patients had successful angioplasty of all three major vessels and 40 (80%) had successful dilation of all vessels and branches in which angioplasty was attempted. All 50 patients were clinically improved after the procedure.

In four additional patients triple vessel angioplasty was planned but not performed because of failure to dilate the first vessel (two patients) or the second vessel (two patients) and each of these four patients underwent subsequent bypass surgery. With inclusion of these patients, overall clinical success for triple vessel angioplasty was 93% (50 of 54).

Complications. No patient required urgent coronary bypass surgery. Five patients (10%) had a minor myocardial infarction. In one patient infarction was due to subocclusive dissection during attempted dilation of an obtuse marginal branch after the right and left anterior descending coronary arteries had been successfully dilated; this caused deterioration of flow with ST elevation for approximately 1 h and subsequent serum creatine kinase elevation to 500 IU/liter (upper normal = 350 IU/liter); in one patient attempted dilation of a relatively small, tortuous diagonal branch resulted in its occlusion after all three major vessels had been dilated (serum creatine kinase was elevated to 1,000 IU/liter and there were small Q waves in leads I and aVL). Two patients developed a distal occlusion (probably due to wire trauma) that was successfully reopened in the laboratory (in one patient the apical left anterior descending artery was occluded, in the other the distal obtuse marginal branch, and the occlusion was accompanied by serum creatine kinase elevation to approximately 500 IU/liter in both). One patient had abrupt closure of a left anterior descending artery graft that was successfully redilated in the laboratory but caused serum creatine kinase elevation to 444 IU/liter and ischemic T wave changes without prolonged pain. Despite the evidence of a small infarction, each of the five patients had clinical improvement from the procedure. Relevant noncardiac complications included entry site hematoma requiring transfusions in one patient and leg infection requiring antibiotic treatment in another patient.

Table 3. Follow-up Outcome After Successful Triple Vessel Angioplasty in 50 Patients

	>12 months	>6 months
No. of Patients	32	50
Mean Follow-up time (mo)	34	18.4
Follow-up events	2 (6%)	4 (8%)
Clinical recurrence	11 (34%)	17 (34%)
Repeat PTCA	0	15
Success, 2nd PTCA	9	15
CABG	2 (6%)	2 (4%)
MI	2 (6%)	2 (4%)
Death	0	2 (4%)
Cardiac transplantation		1 (2%)
Event free, improved (no MI or death)	30 (94%)	46 (92%)
Asymptomatic	24 (75%)	37 (74%)
Continued success*	30 (94%)	45 (90%)

*Defined as improvement without surgery; the data include patients with myocardial infarction (MI) and repeat angioplasty (PTCA). CABG = coronary artery bypass graft.

Of the four patients in whom triple vessel angioplasty was planned but not performed, one required urgent bypass surgery because of unresolved acute reclosure of the first vessel, and this was associated with myocardial infarction. In the other three patients dilation of the first or second vessel was unsuccessful but uncomplicated, and these patients had elective bypass surgery. With inclusion of these four patients, the overall incidence rate of myocardial infarction was 11% (6 of 54) and that of urgent surgery 1.8% (1 of 54).

Follow-up (Tables 3 and 4). All 50 patients had completed at least 6 months of follow-up after triple vessel angioplasty, and 32 had completed at least 12 months (Table 3). Information on clinical status was obtained through August 1987. Follow-up duration ranged from 6 to 63 months (mean 18.4 months). Forty-six patients (92%) had maintained clinical improvement and sustained no major event (myocardial infarction or death) during follow-up. Twenty-nine patients (58%) had continued clinical improvement without a major event or need of further revascularization during follow-up. Of those 29 patients, 24 (48%) remained asymptomatic since angioplasty, and 5 were in functional class I (1 of these had recurrent chest pain 30 months after the procedure and underwent repeat angiography, which revealed wide patency

Table 4. Functional Class at Last Follow-up Before and After Triple Vessel Angioplasty

CHC Functional Class	Before PTCA (no. of patients)	Follow-up (no. of patients)	
		>6 months	>12 months
0	0	37*	24*
I	0	8	6
II	2	0	0
III	21	0	0
IV	27	0	0
Total	50	45†	30‡

*The data include patients with myocardial infarction and patients who had successful repeat angioplasty. †The data does not include patients who had surgery or died during follow-up. Abbreviations as in Table 1 and 3.

at each dilated site and progression of coronary disease in a small branch vessel and a distal segment; this patient has remained improved on medical therapy). Of the remaining 21 patients, 17 (34%) had clinical recurrence of symptoms, 2 (4%) had myocardial infarction (in 1 of these patients myocardial infarction was the presentation of clinical recurrence), 2 (4%) died suddenly and 1 patient underwent cardiac transplantation.

In the 17 patients who developed clinical recurrence, this was evident at a mean of 5.6 months (range 2 to 12 mo) after angioplasty. Coronary angiography revealed restenosis in only one vessel in six patients, in two vessels in nine, and in all vessels dilated in two. The latter two patients were not considered candidates for repeat angioplasty because of progression to significant left main stenosis in one patient and significant progression of disease in several other vessels in the other; each of these underwent elective bypass surgery. Angioplasty was successfully repeated in the other 15 patients with clinical recurrence; 12 of these are now asymptomatic and 3 are in functional class I (1 patient had a second recurrence after 4 months, underwent successful redilation and is now free of angina). Of the two patients with myocardial infarction, the first developed acute anterior infarction 25 months after angioplasty and had successful reperfusion with intravenous streptokinase therapy; cardiac catheterization performed after this intervention showed nonsignificant disease (40% residual stenosis) in the infarct-related vessel and no restenosis in the other vessels; the patient is now asymptomatic on medical therapy. The second patient with myocardial infarction had occlusion of a previously dilated vessel and acute angioplasty was successfully performed. In the two patients who died, death occurred at 4 months after angioplasty and was sudden; in one case ventricular fibrillation was documented.

The patient who underwent cardiac transplantation during follow-up had severe dilated cardiomyopathy at baseline and underwent triple vessel angioplasty because he was considered an unfavorable candidate for surgical revascularization. He had no subsequent angina and a control angiogram obtained 3 months after the procedure showed no restenosis; however, he had a progressive decline in left ventricular function and intractable congestive heart failure and underwent cardiac transplantation 6 months after angioplasty. Angiographic and pathologic examination of the coronary arteries of the explanted heart showed wide patency of the previously dilated vessels.

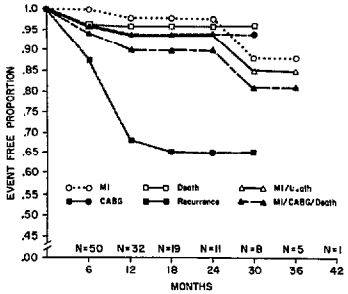

Figure 2. Actuarial curves of follow-up status of 50 patients after triple vessel angioplasty. The event-free proportion at 2 years for myocardial infarction (MI), coronary bypass surgery (CABG), death and clinical recurrence was 98, 94, 96 and 65%, respectively.

At last follow-up (Table 4), with the inclusion of patients who had repeat angioplasty, 44 (88%) of the 50 patients are asymptomatic or improved (36 [72%] are asymptomatic, 8 are in functional class I); with the inclusion of the patient who had a myocardial infarction and is asymptomatic without coronary lesions after thrombolysis, 45 (90%) of the 50 patients remain in improved condition without bypass surgery. Life table analysis of follow-up status is illustrated in Figure 2. Survival at 24 months was 96%; 98% of patients had not had myocardial infarction, 94% did not require bypass surgery and 90% were alive without myocardial infarction or need for bypass surgery 2 years after angioplasty.

Discussion

The initial recommendations for coronary angioplasty were restricted to patients with single vessel disease or to patients with multivessel disease in whom a single vessel was dilated. Coronary angioplasty is now being increasingly performed in selected patients with multivessel disease, and results with angioplasty of multiple coronary arteries indicate that the procedure can be safely and effectively applied in patients with more complex anatomy (3). In previous reports (3–6) of coronary angioplasty of multiple vessels, the

majority of patients had two vessel disease or dilation of two vessels or branches. Early and long-term outcome of the subgroup of patients with significant three vessel disease who undergo angi asty of all three major vessels has not been described. Our results with triple vessel angioplasty in 50 patients over a 4.5 year period demonstrate that satisfactory immediate and long-term results can be achieved in selected patients.

Primary success. In our series 84% of patients had revascularization of all three major vessels with angioplasty, and clinical improvement was achieved in all 50 patients in whom angioplasty of all three major vessels was attempted. In the majority of cases, the unsuccessful angioplasty involved a chronic total occlusion that could not be crossed with the wire or could not maintain stable patency after dilation. This lower success rate for angioplasty of totally occluded vessels is consistent with previous reports (8); nevertheless, the majority of totally occluded vessels in our study were successfully dilated. Most patients had multiple lesions in one or more of the three major vessels and in some cases distal and diffuse lesions were dilated. Triple vessel angioplasty was not attempted if bypass surgery was considered to offer more complete revascularization or lower risk. The clinical success rate was high (in 50 [93%] of 54 patients in whom triple vessel angioplasty was planned) and was similar to that of our overall patient population during the same period. This reflects careful patient selection, in that each patient had, in all major segments, important disease that appeared technically suitable for angioplasty with reasonable probability of success. Therefore, patients who had triple vessel angioplasty are a highly selected population who do not represent the general population with three vessel disease who require revascularization. It is estimated that this study group represents 5 to 10% of patients with three vessel disease who undergo revascularization at our center.

Complications. The incidence of myocardial infarction in this group of patients was higher than that reported with single vessel angioplasty (11); however, each of the five patients with infarction had a small serum enzyme elevation indicating that myocardial damage was limited. Myocardial infarction was due to distal occlusion in two patients, branch occlusion in two others and to abrupt in-laboratory reclosure in another; simultaneous acute reclosure of multiple vessels was not observed. No patient required urgent coronary bypass surgery, and there were no deaths. This may reflect patient selection and strategy; the majority of patients (75%) had good left ventricular function (ejection fraction >50%), and a staged approach was used in 56% of the patients in order to minimize the risk of multiple acute occlusions. In addition, a vessel supplying collateral flow was never dilated as a primary vessel in order not to jeopardize extensive myocardial zones in the event of failure.

Follow-up. The long-term results during a mean follow-up period of >1.5 years indicate that continued success with angioplasty was achieved in 90% of the patients; 74% of the patients were asymptomatic and the remaining 16% had minimal anginal symptoms. Overall, 88% of patients had no myocardial infarction, death or bypass surgery during the follow-up period. Each of the two deaths occurred at 4 months after angioplasty; ventricular arrhythmia was demonstrated in one of these patients and was the probable cause of the sudden death of the other. Although angiographic or pathologic documentation of the coronary anatomy is not available in these two patients we cannot exclude restenosis as a cause of those events. The clinical recurrence rate of 34% after triple vessel angioplasty is similar to that reported after multiple vessel angioplasty (3,6,7,12). The angiographic patterns of restenosis in patients with clinical recurrence is similar to that observed after angioplasty of multiple vessels (13); that is, restenosis frequently involves only one vessel. Such patients therefore may be technically more amenable to repeat angioplasty, and in our study repeat dilation was successful in all 15 patients in whom it was attempted.

Conclusions. This patient population represents a selected group of patients with three vessel coronary artery disease who underwent angioplasty of all three major vessels; however with appropriate strategy and selection triple vessel angioplasty has been performed with an acceptable rate of complications, excellent immediate results and satisfactory long-term outcome. Thus, it appears that triple vessel angioplasty is a safe and effective therapy that may represent a reasonable alternative to surgical revascularization in selected patients with three vessel coronary artery disease.

References

1. Gruentzig AR, Senning A, Siegenthaler WE. Non-operative dilatation of coronary artery stenosis: percutaneous transluminal coronary angioplasty. N Engl J Med 1979;301:61–8.
2. Cowley MJ, Vetrovec GW, Wolfgang TC. Efficacy of percutaneous transluminal coronary angioplasty: technique, patient selection, salutory results, limitations and complications. Am Heart J 1981;101:272–80.
3. Cowley MJ, Vetrovec GW, DiSciascio G, Lewis SA, Hirsh PA, Wolfgang TC. Coronary angioplasty of multiple vessels: short-term outcome and long-term results. Circulation 1985;72:1314–20.
4. Dorros G, Stertzer SH, Cowley MJ, Myler RK. Complex coronary angioplasty: multiple coronary dilatations. Am J Cardiol 1984; 53:126C–30C.
5. Vandormael MG, Chaitman BR, Ischinger T, et al. Immediate and short-term benefit of multilesion coronary angioplasty: influence of degree of revascularization. J Am Coll Cardiol 1985;6:983–91.
6. Mata LA, Bosch X, David PR, Rapold HJ, Corcos T, Bourassa RG. Clinical and angiographic assessment 6 months after double vessel percutaneous transluminal coronary angioplasty. J Am Coll Cardiol 1985;6:1239–44.
7. Myler RK, Topol EJ, Shaw RE, et al. Multiple vessel coronary angioplasty: classification, results, and patterns of restenosis in 494 consecutive patients. Cathet Cardiovasc Diagn 1987;13:1–15.

8. DiSciascio G, Vetrovec GW, Cowley MJ, Wolfgang TC. Early and late outcomes of PTCA for subacute and chronic total coronary occlusion. Am Heart J 1986;111:833–9.

9. Cowley MJ, Dorros G, Kelsey SF, Van Raden M, Detre K. Acute coronary events associated with percutaneous transluminal coronary angioplasty. Am J Cardiol 1984;53:12C–6C.

10. Cutler SJ, Ederer F. Maximum utilization of life table method in analyzing survival. J Chronic Dis 1958;8:699–712.

11. Bredlau CE, Roubin GS, Leimgruber PP, Douglas JS, King SB, Gruentzig AR. In-hospital morbidity and mortality in patients undergoing elective coronary angioplasty. Circulation 1985;72:1044–52.

12. DiSciascio G, Cowley MJ, Vetrovec GW, Wolfgang TC. Clinical recurrence rates following coronary angioplasty of single lesions, multiple (tandem) lesions and multiple vessels (abstr). Circulation 1985;72(suppl III):III-398.

13. DiSciascio G, Cowley MJ, Vetrovec GW. Angiographic patterns of restenosis after angioplasty of multiple coronary arteries. Am J Cardiol 1986;58:922–5.